FCC PART 74
EMI MEASUREMENT AND TEST REPORT

For

Nady Systems, Inc.

6701 Shellmond Street
Emeryville, CA 94608 USA

FCC ID: BEK9E31415T

June 5, 2001

This Report Concerns:	**Equipment Type:**
☒ Original Report	Transmitter

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Test Date: May 21, 2001

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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *Nady Systems, Inc.*'s product, FCC ID*: BEK9E31415T* or the "EUT" as referred to in this report is a transmitter which measures approximately 8.0"L x 5.0"W x 1.5"H.

The FCC ID is representative the following family products: WLT-15, WLT-14, WGT-15, WGT-14.

1.2 Objective

This report is prepared on behalf of *Nady Systems, Inc.* in accordance with Part 74 Subpart H of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for peak output power, modulation characteristics, occupied bandwidth of emission, spurious emission, field strength of spurious radiation, frequency stability and line conduction.

1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4 –1992, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.4 Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Suite 2, Sunnyvale, California, USA.

Test site at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, IEC/CISPR 22: 1998, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

1.5 Test Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Due Date
HP	Spectrum Analyzer	8566B	2610A02165	12/6/01
HP	Spectrum Analyzer	8593B	2919A00242	12/20/01
HP	Amplifier	8349B	2644A02662	12/20/01
HP	Quasi-Peak Adapter	85650A	917059	12/6/01
HP	Amplifier	8447E	1937A01046	12/6/01
A.H. System	Horn Antenna	SAS0200/571	261	12/27/01
Com-Power	Log Periodic Antenna	AL-100	16005	11/2/01
Com-Power	Biconical Antenna	AB-100	14012	11/2/01
Solar Electronics	LISN	8012-50-R-24-BNC	968447	12/28/01
Com-Power	LISN	LI-200	12208	12/20/01
Com-Power	LISN	LI-200	12005	12/20/01
BACL	Data Entry Software	DES1	0001	12/20/01
Rohde & Schwarz	Signal Generator	SMIQ03B	1125.5555.03	7/10/02
Rohde & Schwarz	I/Q Modulation Generator	AMIQ	1110.2003.02	8/10/02

1.6 Equipment Under Test (EUT)

Manufacturer	Description	Model	Serial Number	FCC ID
Nady Systems, Inc.	Transmitter	WLT-14, WLT-15, WGT-15	None	BEK9E31415T

2 – REQUIREMENTS OF PROVISIONS

2.1 Definition

Intentional radiator: a device that intentionally generates and emits radio frequency energy by radiation or induction.

2.2 Frequencies Available

According to Sec. 74.802 of Part 74, the following frequencies are available for low power auxiliary station:

Frequencies (MHz)

26.100-26.480 455.000-456.000
54.00-72.0 47.000-488.000
76.00-88.0 488.000-494.000
161.625-161.775 614.000-806.000
450.000-451.000 944.000-952.000

2.3 Requirements and Test Summary

Rules Description	FCC Rules	Test Result
RF Output Power	§74.861(e)(1)(i)	Passed
Modulation Characteristics	§2.1047(a)	Passed
Occupied Bandwidth	§2.1049(c)(1)	Passed
Spurious Emissions at Antenna Terminals	§2.1051 & §74.861(e)(6)	Passed
Field Strength of Spurious Emissions	§2.1053 & §74.861(e)(6)	Passed
Frequencies Tolerance	§2.1055(a)(1)	Passed

Note: The microphone is not capable of extended audio response, so it is not necessary to be measured up to 15 kHz. Neither it is necessary to do occupied bandwidth test.

2.4 Labeling Requirement

Each equipment for which a type acceptance applications is filed on or after May 1, 1981, shall bear an identification plate or label pursuant to §2.295 (Identification of Equipment) and §2.926 (FCC identifier)

3 – OUTPUT POWER MEASUREMENT

3.1 Provision Applicable

According to § 74.861(e)(1)(i), the output power shall not exceed 50 milliwatts.

3.2 Test Procedure

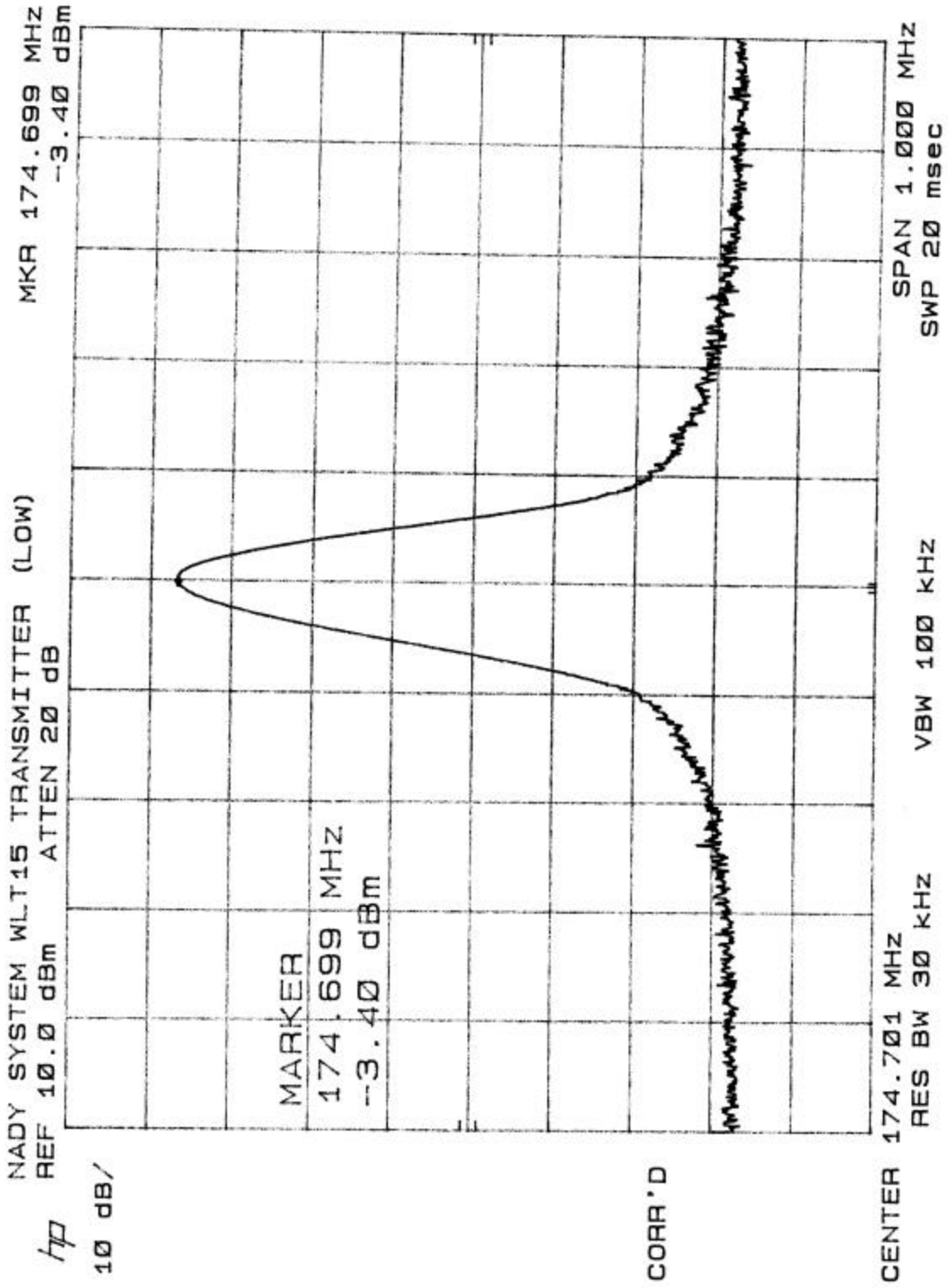
The maximum peak output power was measured with a spectrum analyzer connected to the antenna terminal (conducted measurement) while EUT was operating in normal situation. Set RBW of spectrum analyzer to 100 kHz and VBW to 100 kHz.

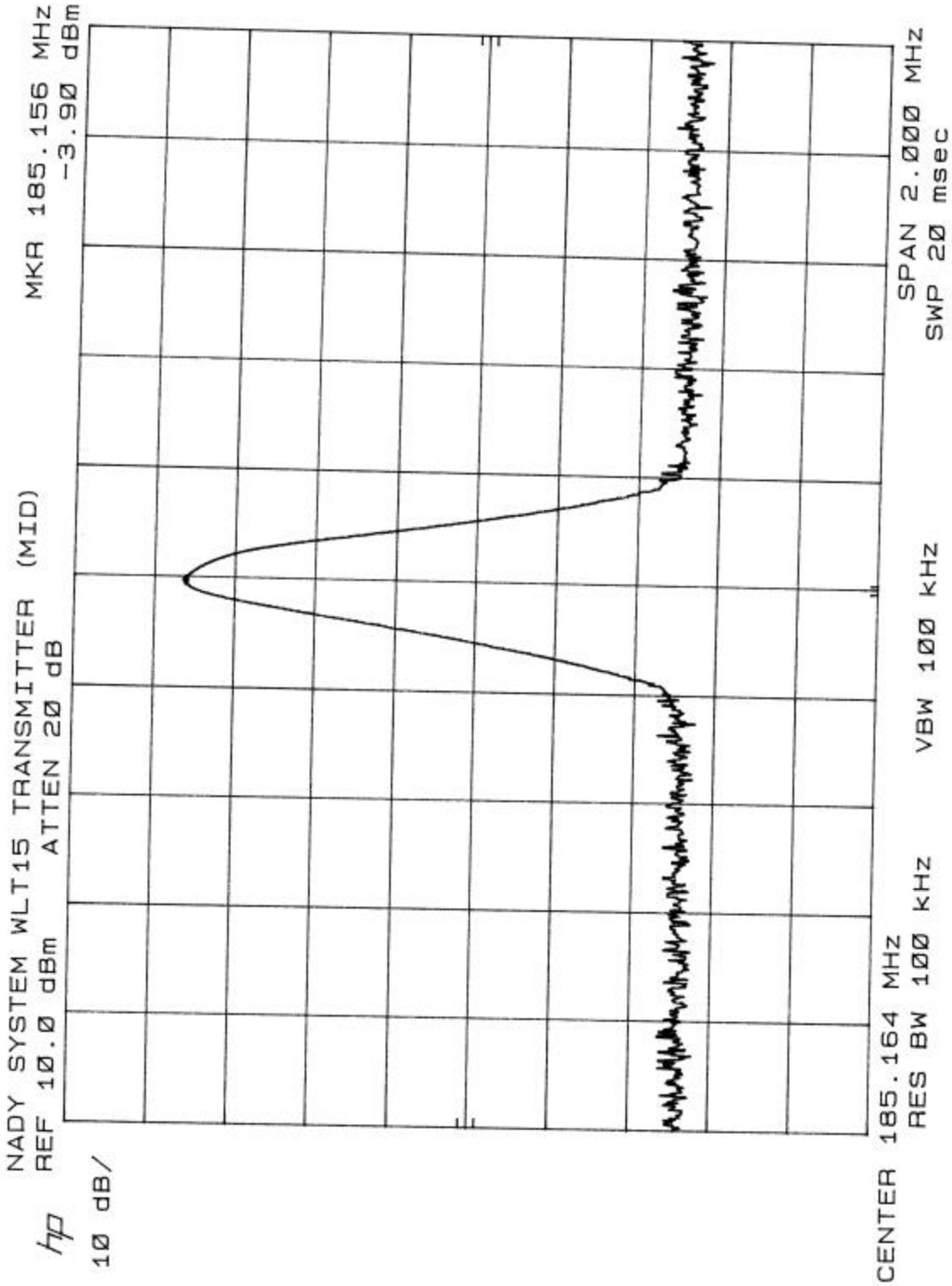
3.3 Test equipment

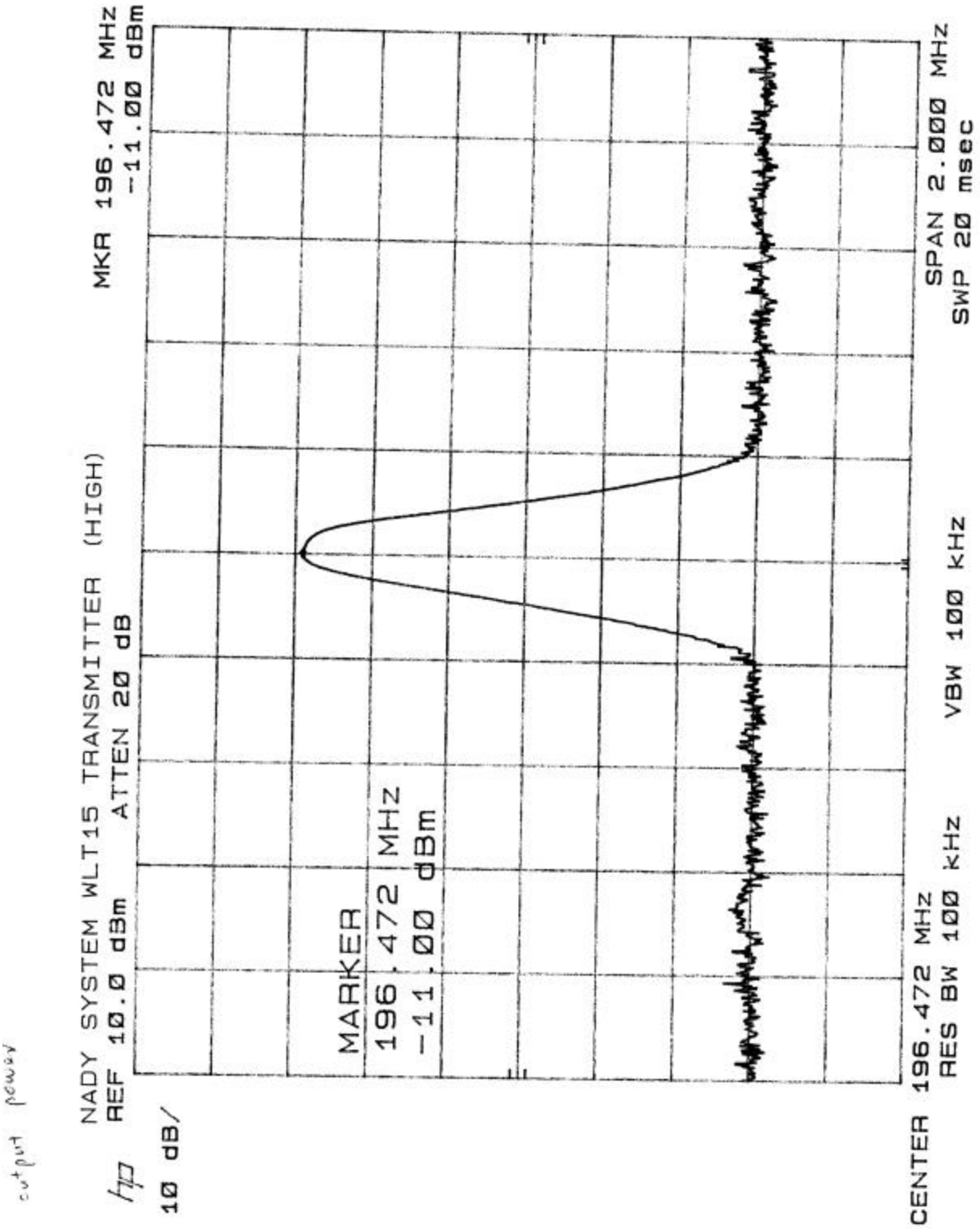
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter

3.4 Test Results

The rated signal power is 0.0004w. The plot (s) of output Peak Power was presented hereinafter as reference.


NADY SYSTEM WLT15 TRANSMITTER (LOW)
REF 10.0 dBm ATTEN 20 dB
MKR 174.699 MHz
-3.40 dBm
10 dB/
MARKER
174.699 MHz
-3.40 dBm
CORR'D
CENTER 174.701 MHz
RES BW 30 kHz
VBW 100 kHz
SPAN 1.000 MHz
SWP 20 msec


NADY SYSTEM WLT15 TRANSMITTER (MID)
REF 10.0 dBm ATTEN 20 dB
MKR 185.156 MHz
-3.90 dBm
10 dB/
CENTER 185.164 MHz
RES BW 100 kHz
VBW 100 kHz
SPAN 2.000 MHz
SWP 20 msec



output power

4 - MODULATION CHARACTERISTICS

4.1 Provision Applicable

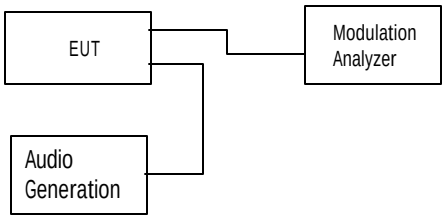
According to FCC 2.1047 (a), for Voice Modulated Communication Equipment, the frequency response of the audio modulating circuit over a range of 100Hz to 5000Hz shall be measured.

4.2 Test Procedure

4.2.1 Frequency response of audio circuits

1) Position the EUT as shown in figure 1

Figure 1: Modulation Characteristic Measurement Configuration



2) Adjust the audio input frequency for 100, 200, 500, 1000, 3000 and 5000Hz in sequence and the input level from 0V to maximum permitted input voltage with recording each carrier frequency deviation responding to respective input level

4.2.2 Modulation Limit

1) Position the EUT as shown in figure 1, adjust the audio input frequency to 100 Hz and the input level from 0V to maximum permitted input voltage with recording each carrier frequency deviation responding to respective input level.
2) Repeat step 1 with changing the input frequency for 200, 500, 1000, 3000 and 5000 Hz in sequence.

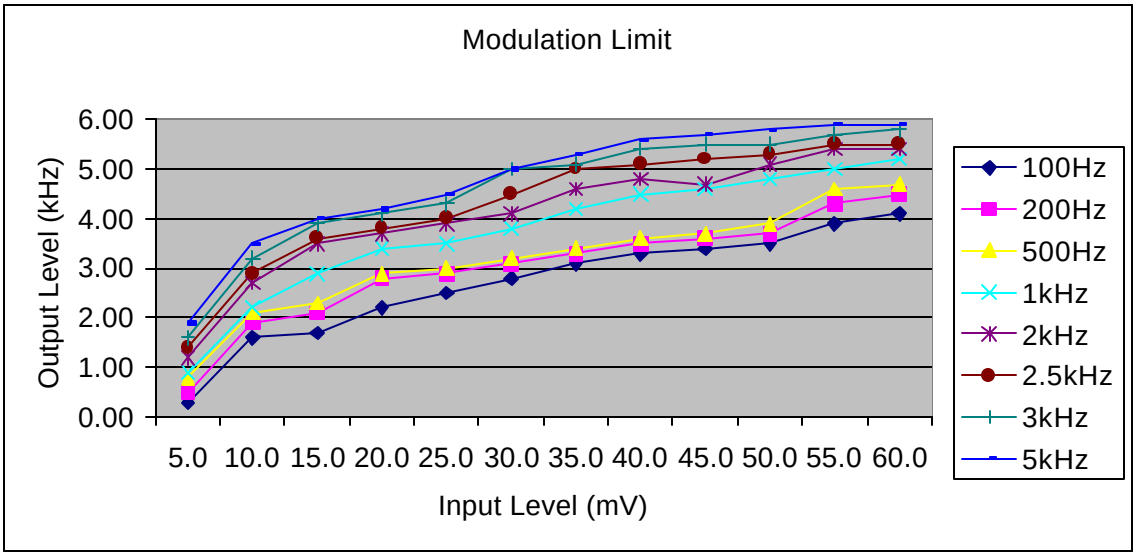
4.3 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
Hewlett Packard HP8901A Modulation Analyzer
Lecroy 9350A Oscillscope

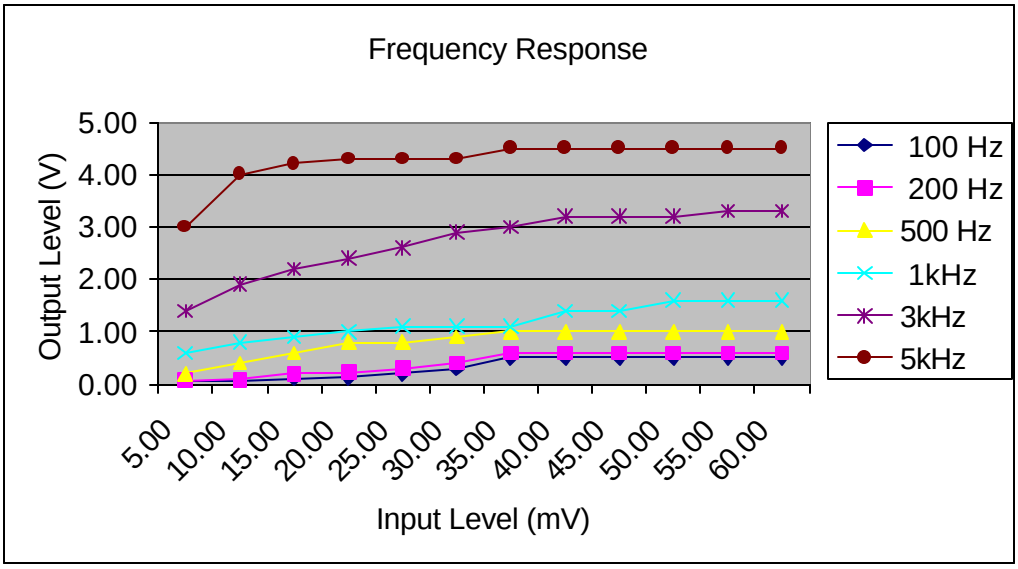
4.4 Test Results

The curve(s) of modulation characteristic is presented hereinafter as reference.

Modulation Limit



Frequency Response



5 - OCCUPIED BANDWIDTH OF EMISSION

5.1 Provision Applicable

According to FCC 2.1049 (c) (1), for radiotelephone transmitter, other than single sideband or independent sideband transmitter, when modulated by a 2.5 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation.

According to FCC 74.861 (e)(5), the frequency emission bandwidth shall not exceed 200 kHz.

5.2 Test Procedure

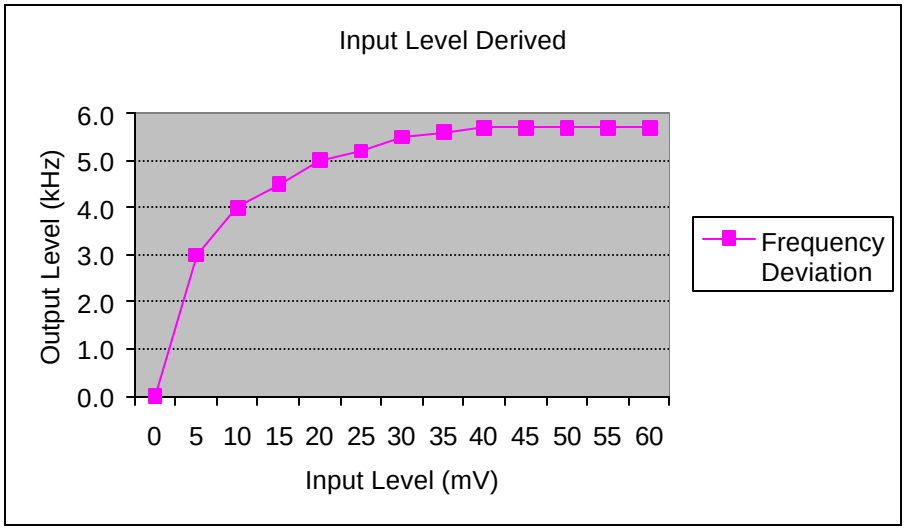
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Install new batteries in the EUT. Turn on the EUT and set it to any one convenient frequency within its operating range.

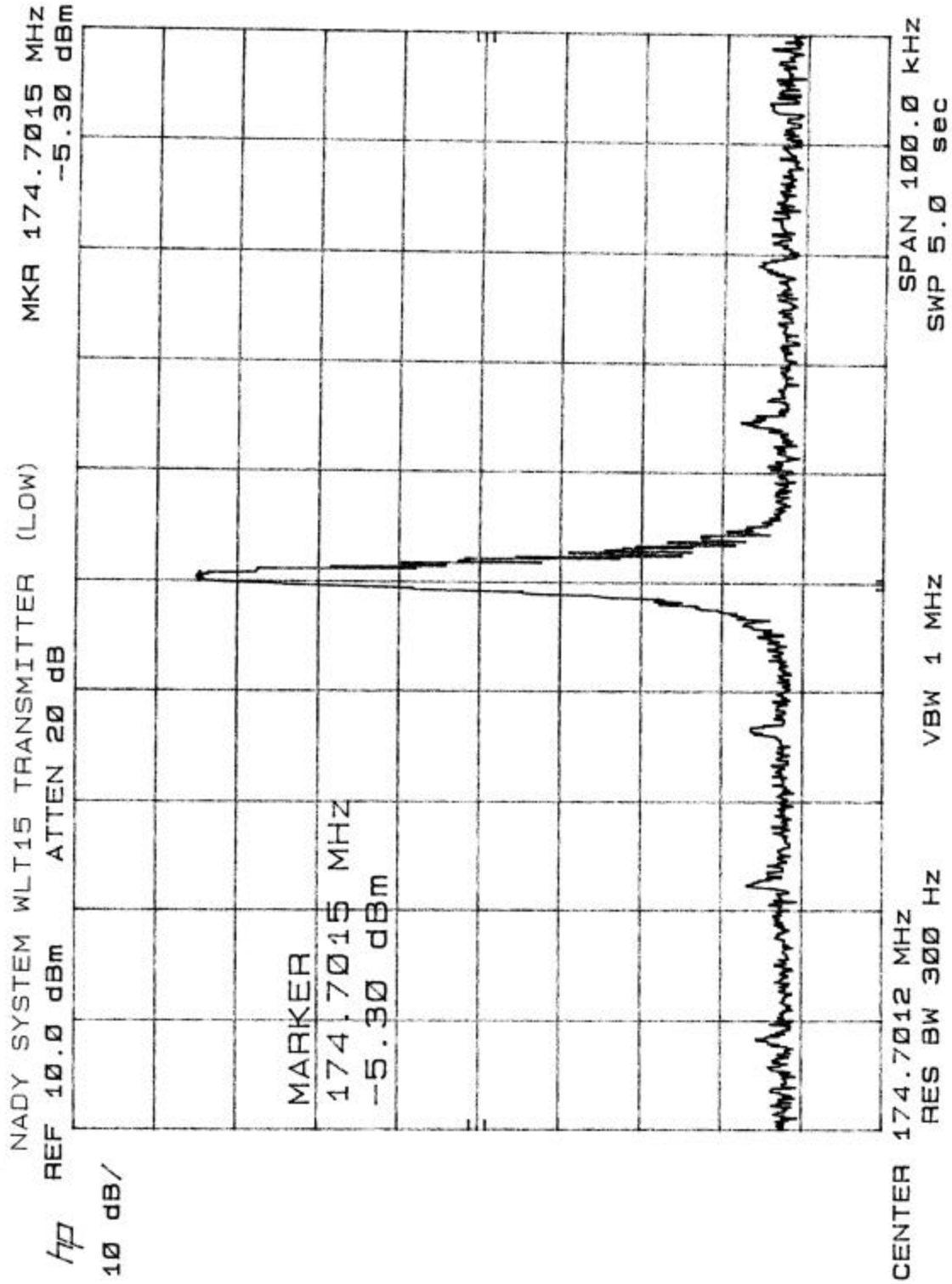
5.3 Test Equipment

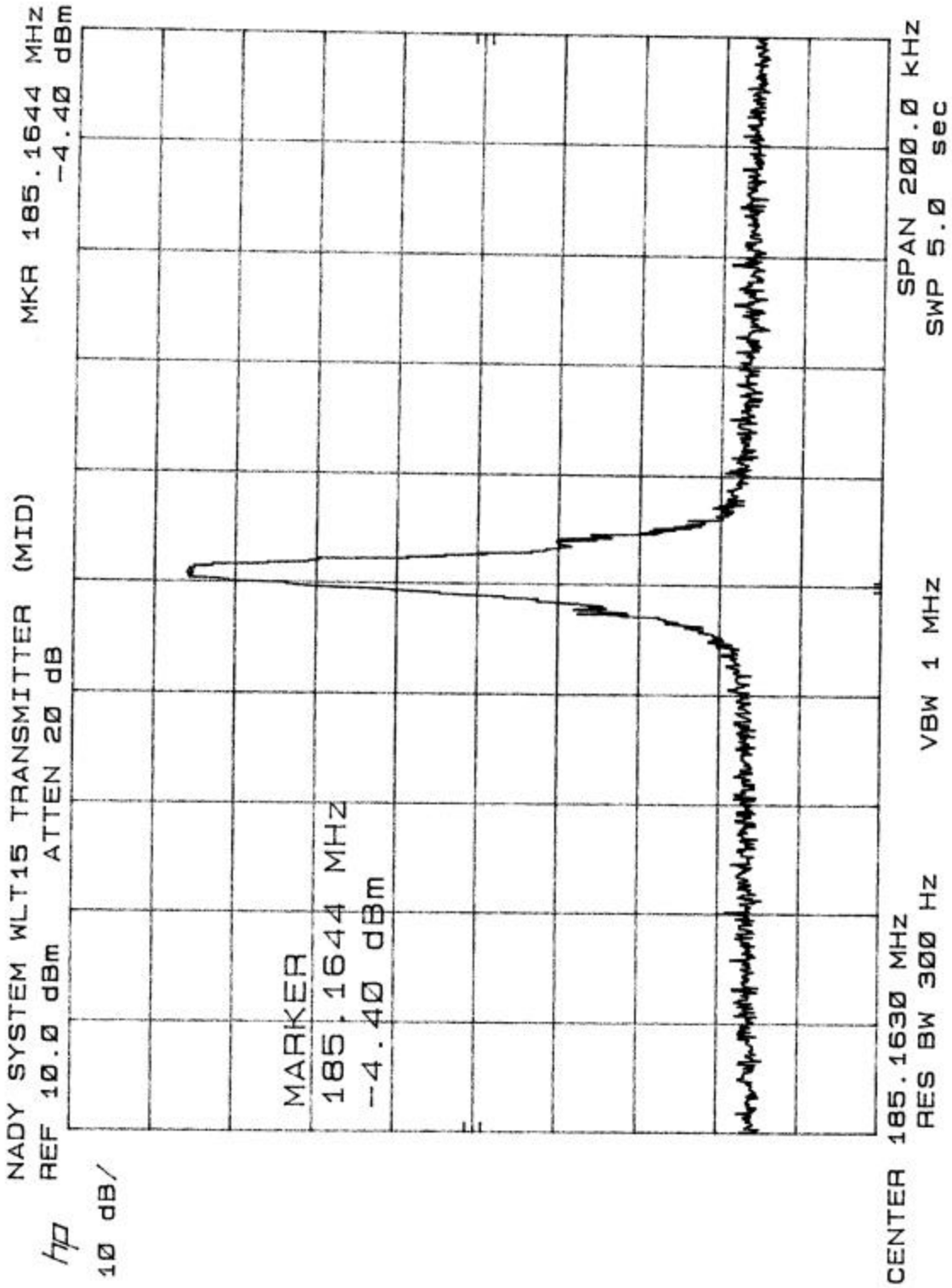
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter

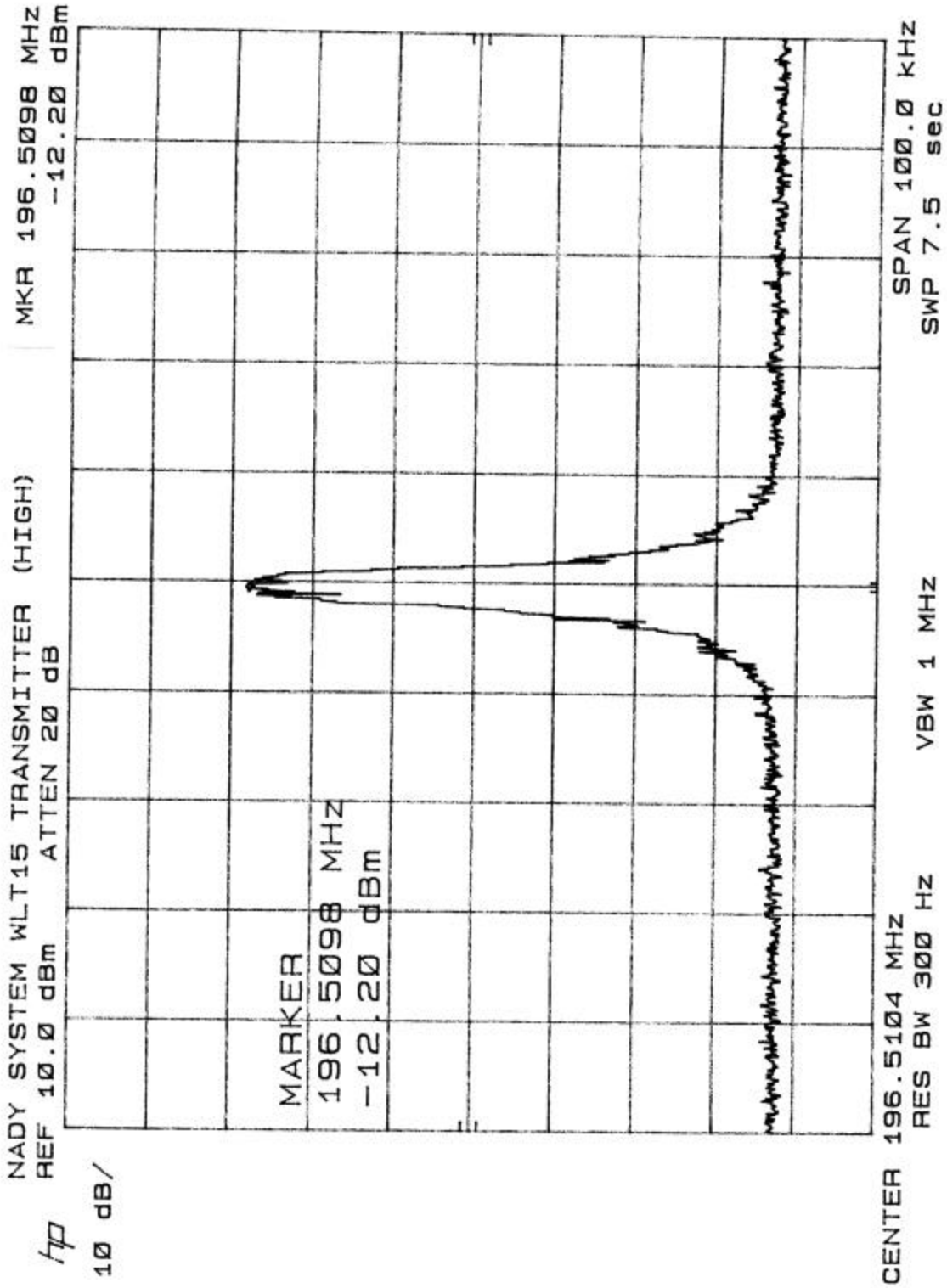
5.4 Test Results

Please refer the following curve and plots.




NADY SYSTEM WLT15 TRANSMITTER (LOW)
REF 10.0 dBm
ATTEN 20 dB
MKR 174.7015 MHz
-5.30 dBm
10 dB/
MARKER
174.7015 MHz
-5.30 dBm
CENTER 174.7012 MHz
RES BW 300 Hz
VBW 1 MHz
SPAN 100.0 kHz
SWP 5.0 sec


NADY SYSTEM WLT15 TRANSMITTER (MID)
REF 10.0 dBm ATTEN 20 dB
MKR 185.1644 MHz
-4.40 dBm
10 dB/
MARKER
185.1644 MHz
-4.40 dBm
CENTER 185.1630 MHz
RES BW 300 Hz
VBW 1 MHz
SPAN 200.0 kHz
SWP 5.0 sec


NADY SYSTEM WLT15 TRANSMITTER (HIGH)
REF 10.0 dBm ATTEN 20 dB
MKR 196.5098 MHz
-12.20 dBm
10 dB/
MARKER
196.5098 MHz
-12.20 dBm
CENTER 196.5104 MHz
RES BW 300 Hz
VBW 1 MHz
SPAN 100.0 kHz
SWP 7.5 sec

6 - FIELD STRENGTH OF EMISSION

6.1 Provision Applicable

According to FCC2.1053, measurements shall be made to detect spurious emission that may be radiated directly from the cabinet, control circuits, power leads, or intermediated circuit elements under normal condition of installation and operation. Information submitted shall include the relative radiated power of spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from a halfwave dipole antenna.

According to FCC74.861 (e)(6), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

1. on any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB.

2. on any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB.

3. on any frequency removed from the operating frequency by more than 250 percent up to and the authorized bandwidth shall be attenuated below the un-modulated carrier by at least 43 plus 10 Log (output power in watts)dB.

6.2 Test Procedure

1. Setup the configuration frequencies measured below and above 1GHz respectively, adjusting the input voltage to produce the maximum power as measured in chapter 3.

2. Adjust the analyzer for each frequency measured in chapter 6 on a 1MHz frequency span and 100kHz resolution bandwidth.

3. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the height when the highest value is indicated on spectrum analyzer, the change the orientation of EUT on test table over a range for 0º to 360º, and record the highest value indicated on spectrum analyzer as reference value.

4. Repeat step 3 until all frequencies need to be measured were completed.

5. Repeat step 4 with search antenna in vertical polarized orientations.

6. Replace the EUT with a tuned dipole antenna (horn antenna for above 1GHz) relative to each frequency in horizontally polarized orientation and as the same polarized orientation with search antenna. Connect the tuned dipole antenna to a standard signal generator (SG) via a low loss cable. Power on the SG and tune the right frequency in measuring as well as set SG at an appreciated output level. Rise and lower the search antenna to get the highest value on spectrum analyzer, and then hold this position. Adjust the SG output to get an identical value derived from step 3 on spectrum analyzer. Record this value for result calculated.

7. repeat step 6 until all frequencies need to be measured were completed.

8. repeat step 7 in vertical polarized orientations.

6.3 Test Equipment

A.H. System Horn Antenna

High Pass Filter

Preamplifier

Hewlett Packard HP8566B Spectrum Analyzer

Hewlett Packard HP 7470A Plotter

6.4 Final Test Results from 30 - 2000 MHz

6.4.1 Final Test Data at 174.70 MHz, 30 - 2000MHz

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTEI AMPLITUDE	FCC 74 CLASS B	
Frequency MHz	Ampl. dBmV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dBmV/m	Cable dB	Amp. dB	Corr. Ampl. dBmV/m	Limit dBmV/m	Margin dB
174.70	32.8	90	1.2	V	13.7	3.6	21.5	28.6	80.0	
223.18	62.6	90	1.5	H	16.4	4.0	21.9	61.1	82.2	-21.1
207.23	59.7	270	1.8	H	16.1	3.8	22.4	57.2	82.2	-25.0
873.50	47.9	270	1.4	V	21.0	10.1	22.0	57.0	82.2	-25.2
828.95	44.1	180	1.5	H	21.7	10.1	22.0	53.9	82.2	-28.3
225.06	54.9	90	1.5	H	16.6	4.2	22.0	53.7	82.2	-28.5
698.80	44.8	90	1.4	H	20.4	8.5	22.8	50.9	82.2	-31.3
1048.20	37.1	160	1.4	H	22.8	10.7	20.5	50.1	82.2	-32.1
524.10	44.7	90	1.3	H	18.3	7.5	23.5	47.0	82.2	-35.2
239.13	46.9	270	1.5	H	17.1	4.5	21.9	46.6	82.2	-35.6
892.72	36.7	90	1.2	V	20.7	10.3	22.0	45.7	82.2	-36.5
510.11	41.7	90	1.4	H	18.8	7.4	23.3	44.6	82.2	-37.6
349.40	47.1	270	1.4	V	13.8	5.7	22.4	44.2	82.2	-38.0
127.50	40.5	0	1.4	V	11.2	3.1	21.4	33.4	82.2	-48.8
159.40	32.9	180	1.5	V	13.3	3.5	22.3	27.4	82.2	-54.8

6.4.2 Final Test Data at 185.16 MHz, 30-2000MHz

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 74 CLASS B	
Frequency MHz	Ampl. dBmV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dBmV/m	Cable dB	Amp. dB	Corr. Ampl. dBmV/m	Limit dBmV/m	Margin dB
185.16	43.0	90	1.5	H	13.9	3.8	21.6	39.1	90.8	
370.32	71.5	80	1.0	H	15.1	6.6	23.2	70.0	99	-29.0
370.32	57.7	90	1.2	V	14.5	6.6	23.2	55.6	99	-43.4
555.48	45.8	270	1.8	H	18.2	8.0	23.3	48.7	99	-50.3
740.64	42.5	180	1.5	H	20.5	9.2	23.8	48.4	99	-50.6
740.64	43.1	90	1.5	V	19.6	9.2	23.8	48.1	99	-50.9
925.80	36.0	0	1.4	H	22.5	10.2	22.4	46.3	99	-52.7
925.80	36.2	90	1.4	V	21.8	10.2	22.4	45.8	99	-53.2

6.4.3 Final Test Data at 196.51 MHz, 30-2000MHz

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	FCC 74 CLASS B	
Frequency MHz	Ampl. dBmV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dBmV/m	Cable dB	Amp. dB	Corr. Ampl. dBmV/m	Limit dBmV/m	Margin dB
196.51	41.0	90	1.5	H	15.1	4.1	22.1	38.1	83.0	
786.04	59.8	180	1.2	V	20.9	9.5	22.6	67.6	82.2	-14.6
932.54	50.7	270	1.2	V	22.2	10.4	21.2	62.1	82.2	-20.1
1179.06	50.4	30	2.0	V	21.5	10.7	20.5	62.1	82.2	-20.1
286.92	55.3	90	1.5	H	19.7	5.3	22.3	58.0	82.2	-24.2
393.02	58.8	215	1.0	H	15.5	6.4	22.8	57.9	82.2	-24.3
589.53	52.1	270	1.0	H	19.0	8.1	23.5	55.7	82.2	-26.5
233.13	51.1	160	1.6	V	17.4	4.2	22.0	50.7	82.2	-31.5
573.87	46.3	270	1.0	H	18.5	8.1	23.7	49.2	82.2	-33.0
982.55	36.2	330	1.4	H	22.8	10.4	21.3	48.1	82.2	-34.1
358.67	45.2	30	1.2	H	14.7	6.0	23.0	42.9	82.2	-39.3
322.80	39.1	90	1.2	H	14.2	5.6	22.7	36.2	82.2	-46.0
143.45	41.2	180	2.0	V	12.1	3.1	21.2	35.2	82.2	-47.0
124.98	37.5	90	1.0	H	11.1	3.0	21.5	30.1	82.2	-52.1

* The emission designator is 50KOF3E.

7 - FREQUENCY STABILITY MEASUREMENT

7.1 Provision Applicable

According to FCC 2.1055(a)(1), the frequency stability shall be measure with variation of ambient temperature from –30ºC to +50ºC, and according to FCC 2.1055(d)(2), the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point which is specified by the manufacturer.

According to FCC 74.86(e)(4), the frequency tolerance of the transmitter shall be 0.005 percent.

7.2 Test Procedure

A) Frequency stability versus environmental temperature

1. Setup the configuration 7 for frequencies measured at ambient temperature if it is with 15ºC to 25ºC. otherwise, an environmental chamber set for a temperature of 20ºC shall be used. Install new batteries in the EUT.

2. Turn on EUT and set SA center frequency to the right frequency needs to be measured, then set SA RBW to 30kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.

3. Set the temperature of chamber to 50ºC. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.

4. Repeat step 2 with a 10ºC decreased per stage until the lowest temperature -30ºC is measured, record all measurement frequencies.

B) Frequency stability versus input voltage

1. Setup the configuration for frequencies measured at ambient temperature if it is within 15ºC to 25ºC. otherwise, an environmental chamber set for a temperature of 20ºC shall be used. Install new batteries in the EUT.

2. Set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 30 kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.

3. For battery operated only device, supply the EUT primary voltage at the battery operating end point which is specified by the manufactured and record the frequency.

7.3 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter

7.4 Test Results

Reference Frequency: 174.70 MHz, Limit: 0.005%							
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed					
		2 Minutes		5 Minutes		10 Minutes	
		MHz	%	MHz	%	MHz	%
50	New Batt.	174.705	0.003	174.705	0.003	174.705	0.003
40	New Batt.	174.702	0.001	174.703	0.002	174.702	0.001
30	New Batt.	174.703	0.002	174.702	0.001	174.703	0.002
20	New Batt.	174.702	0.001	174.702	0.001	174.702	0.001
10	New Batt.	174.703	0.002	174.702	0.001	174.702	0.001
0	New Batt.	174.703	0.002	174.703	0.002	174.702	0.001
-10	New Batt.	174.702	0.001	174.702	0.001	174.703	0.002
-20	New Batt.	174.702	0.001	174.702	0.001	174.702	0.001

Reference Frequency: 185.16 MHz, Limit: 0.005%							
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed					
		2 Minutes		5 Minutes		10 Minutes	
		MHz	%	MHz	%	MHz	%
50	New Batt.	185.166	0.003	185.166	0.003	185.166	0.003
40	New Batt.	185.162	0.001	185.162	0.001	185.162	0.001
30	New Batt.	185.164	0.002	185.164	0.002	185.164	0.002
20	New Batt.	185.164	0.002	185.162	0.001	185.162	0.001
10	New Batt.	185.164	0.002	185.162	0.001	185.164	0.002
0	New Batt.	185.162	0.001	185.164	0.002	185.162	0.001
-10	New Batt.	185.164	0.001	185.162	0.001	185.162	0.001
-20	New Batt.	185.162	0.001	185.162	0.001	185.162	0.001

Reference Frequency: 196.51 MHz, Limit: 0.005%							
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed					
		2 Minutes		5 Minutes		10 Minutes	
		MHz	%	MHz	%	MHz	%
50	New Batt.	196.516	0.003	196.516	0.003	196.516	0.003
40	New Batt.	196.512	0.001	196.512	0.001	196.514	0.002
30	New Batt.	196.514	0.002	196.512	0.001	196.514	0.002
20	New Batt.	196.512	0.001	196.514	0.002	196.512	0.001
10	New Batt.	196.514	0.002	196.512	0.001	196.514	0.002
0	New Batt.	196.514	0.002	196.512	0.001	196.512	0.001
-10	New Batt.	196.512	0.001	196.512	0.001	196.512	0.001
-20	New Batt.	196.512	0.001	196.512	0.001	196.512	0.001

Test Result: The frequency tolerance rating is 0.003% < 0.005%. Passed.